TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT TA8190F, TA8191F

SILICON MONOLITHIC

CD FOCUS TRACKING SERVO LSI

The TA8190F, TA8191F is a 3-beam type PUH compatible focus tracking servo LSIs to be used in the CD player system.

In combination with a CMOS single chip processor TC9236AF, a CD player system can be composed very simply.

FEATURES

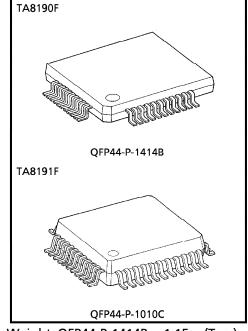
- Built-in RF amp, focus error amp, and tracking error amp.
- Built-in focus tracking servo amp.
- Built-in phase compensation amp and LPF amp. (Regarding these amp, the pin connection differs between the TA8190F and the TA8191F.)
- Built-in ALPC amp.
- Connections between PUH and power driver IC for motor driver allow simplified structuring of CD player system.

TA8190F: Directly connectable to a transistor push-pull

or power driver (TA8212F).

TA8191F: Directly connectable to BTL amp (TA8192F) or PWM driver (TA8460F).

Differences between TA8190F and TA8191F are as follows:



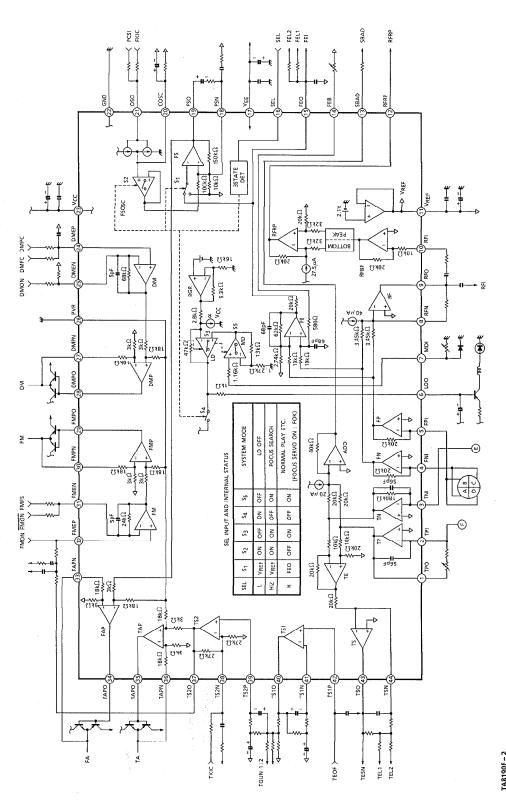
Weight QFP44-P-1414B: 1.15g (Typ.) QFP44-P-1010C : 0.5g

MODEL	REFERENCE VOLTAGE TERMINAL VREF 2VREF		PACKAGE (FLAT PACKAGE 44 PIN)	POWER SUPPLY	APPLICATION	
TA8190F	Yes	No	QFP44-P-1414B	±5V double power supply	CD player	
TA8191F	Yes	Yes	QFP44-P-1010C	+ 5V single power supply	Portable CD player Radio-cassette CD player	

 $(V_{REF} = 2.1V, 2V_{REF} = 4.2V)$

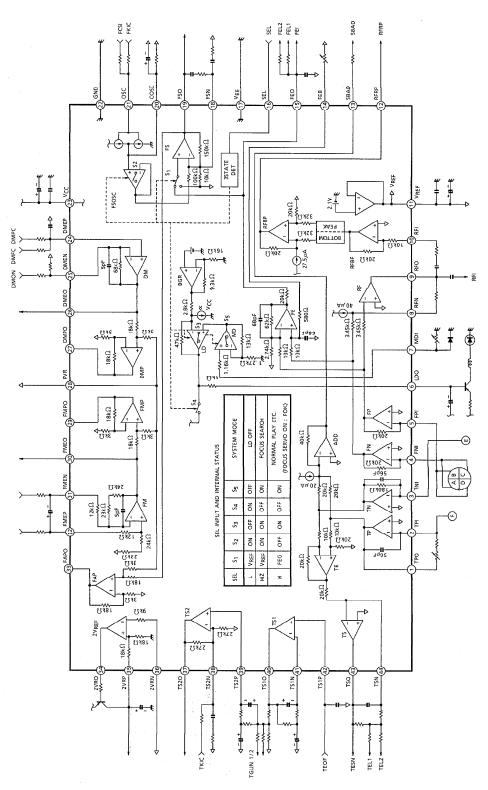
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BLOCK DIAGRAM TA8190F

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BLOCK DIAGRAM TA8191F

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TECHNICAL DATA

TA8190F, TA8191F

PIN FUNCTION (Common)

PIN No.	SYMBOL	1/0	FUNCTIONAL DESCRIPTION	REMARKS
1	ТРО	0	Sub-beam I-V amp (TP AMP) output terminal.	Connected to TPI through adjusting feedback resistor.
2	TPI	I	Sub-beam I-V amp (TP AMP) input terminal.	Connected to PIN diode F.
3	TNI	ı	Sub-beam I-V amp (TN AMP) input terminal.	Connected to PIN diode E.
4	FNI	_	Main-beam I-V amp (FN AMP) input terminal.	Connected to PIN diode A + C.
5	FPI	ı	Main-beam I-V amp (FP AMP) input terminal.	Connected to PIN diode B + D.
6	LDO	0	Laser diode amp (LD AMP) input terminal.	Connected to laser diode circuit.
7	MDI	I	Monitor photo diode amp (MD AMP) input terminal.	Connected to monitor photo diode.
8	RFN	ı	RF amp (RF AMP) negative phase input terminal.	Connected to RFO through feedback resistor.
9	RFO	0	RF amp (RF AMP) output terminal.	_
10	RFI	I	RF ripple signal generating circuit input terminal.	Connected to RFO through CR.
11	VREF	0	Reference voltage supply output terminal. (+2.1V)	_
12	RFRP	0	RF ripple signal output terminal.	_
13	SBAD	0	Defects detection signal output terminal.	_
14	FEB	ı	Focus error balance adjusting input terminal.	Adjusting semi-fixed resistor connected.
15	FEO	0	Focus error amp (FE AMP) output terminal.	Gain adjusting resistor is connected.
16	SEL		Analog switch control signal input terminal.	_
17	VEE	_	Power source terminal. (TA8190F: –5V, TA8191F: GND)	_
18	FSN	I	Focus output amp (FS AMP) negative phase input terminal.	Connected to FSO through feedback CR.
19	FSO	0	Focus output amp (FS AMP) output terminal.	
20	cosc	0	Focus search signal generating capacitor connecting terminal.	CR is connected.
21	OSCI	I	Focus search signal generating built-in current source control input terminal.	_
22	GND		Ground terminal.	_

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TECHNICAL DATA

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(Common)

PIN No.	SYMBOL	1/0	FUNCTIONAL DESCRIPTION	REMARKS
23	Vcc	_	Power source terminal. (+5V)	_
24	DMEP	ı	Disc motor amp (DM AMP) positive phase input terminal.	_
25	DMEN	ı	Disc motor amp (DM AMP) negative phase input terminal.	_
31	FMEN	1	Feed motor amp (FM AMP) negative phase input terminal.	_
32	FMEP	ı	Feed motor amp (FM AMP) positive phase input terminal.	_
37	TS2O	0	Tracking servo amp 2 (TS2 AMP) output terminal.	_
38	TS2N	- 1	Tracking servo amp 2 (TS2 AMP) negative phase input terminal.	_
39	TS2P	ı	Tracking servo amp 2 (TS2 AMP) positive phase input terminal.	_
40	TS1O	0	Tracking servo amp 1 (TS1 AMP) output terminal.	_
41	TS1N	1	Tracking servo amp 1 (TS1 AMP) negative phase input terminal.	Connected to TS10 through feedback CR.
42	TS1P	ı	Tracking servo amp 1 (TS1 AMP) positive phase input terminal.	_
43	TSO	0	Tracking output amp (TS AMP) output terminal.	_
44	TSN	ı	Tracking output amp (TS AMP) negative phase input terminal.	Connected to TSO through feedback CR.

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(TA8190F)

PIN No.	SYMBOL	1/0	FUNCTIONAL DESCRIPTION	REMARKS
26	PVR	I	Driving amp reference voltage input terminal.	Connect to GND.
27	DMPN	ı	Disc motor driving amp (DMP AMP) negative phase input terminal.	_
28	DMPO	0	Disc motor driving amp (DMP AMP) output terminal.	Connected to DMPN through external output Tr.
29	FMPO	0	Feed motor driving amp (FMP AMP) output terminal.	Connected to EMPN through external output Tr.
30	FMPN	I	Feed motor driving amp (FMP AMP) negative phase input terminal.	_
33	FAPN	I	Focus actuator driving amp (FAP AMP) negative phase input terminal.	_
34	FAPO	0	Focus actuator driving amp (FAP AMP) output terminal.	Connected to FAPN through external output Tr.
35	ТАРО	0	Tracking actuator driving amp (TAP AMP) output terminal.	Connected to TAPN through external output Tr.
36	TAPN	ı	Tracking actuator driving amp (TAP AMP) negative phase input terminal.	_

(TA8191F)

PIN No.	SYMBOL	1/0	FUNCTIONAL DESCRIPTION	REMARKS
26	DMEO	0	Disc motor amp (DM AMP) output terminal.	_
27	DMPO	0	Disc motor driving amp (DM AMP) output terminal.	_
28	PVR	I	Driving amp reference voltage input terminal.	Connected to V _{REF} .
29	FMPO	0	Feed motor driving amp (FMP AMP) output terminal.	_
30	FMEO	0	Feed motor amp (FM AMP) output terminal.	_
33	FAPO	0	Focus actuator driving amp (FAP AMP) output terminal.	_
34	2VRO	O	2V _{REF} amp (2V _{REF} AMP) output terminal.	Connected to 2VRP through external output Tr.
35	2VRP	ı	2V _{REF} amp (2V _{REF} AMP) positive phase input terminal.	_
36	2VRN	I	2V _{REF} amp (2V _{REF} AMP) negative phase input terminal.	_

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INTEGRATED CIRCUIT

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TECHNICAL DATA

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MAXIMUM RATINGS (Ta = 25°C)

CHARACTERI	STIC	SYMBOL	RATING	UNIT	
Power Supply Volta	ige	VCC-VEE	0.3~12.0	V	
Dawen Dissipation	TA8190F	D-	960 (*1)	\A/	
Power Dissipation	TA8191F	P_{D}	780 (*2)	mW	
Operating Tempera	ture	T _{opr}	- 25∼75	°C	
Storage Temperatu	re	T _{stg}	- 55∼150	°C	

- (*1) Derated above 25°C in the proportion of 7.7mW/°C.
- (*2) Derated above 25°C in the proportion of 6.2mW/°C.

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, TA8190F : $V_{CC} = 5V$, $V_{EE} = -5V$, $T_{a} = 25^{\circ}C$

TA8191F : $V_{CC} = 5V$, $V_{EE} = GND$, $Ta = 25^{\circ}C$

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СН	ARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power	Power Supply	Vcc	_	Ta = −25~75°C	4.5	5.0	5.5	v
Source	Voltage	VEE	_	· 1a = -25~75 C		- 5.0	- 4.5	V
(TA8190F)	Power Supply	ICC	1	SEL = HiZ	14.0	24.0	32.0	mA
(1701301)	Current	IEE	1	_	3.0	5.0	7.0	IIIA
Power Source	Power Supply Voltage	VCC	_	Ta = − 25~75°C	4.5	5.0	5.5	٧
(TA8191F)	Power Supply Current	ICC	3	_	14.0	24.0	32.0	mA
Reference	Reference Voltage	V _{REF}	1, 3	_	1.95	2.10	2.25	V
Power Supply	Reference Voltage Temperature Characteristic	ΔV/ΔΤ	1, 3		- 3.0	- 2.0	- 1.0	mV/°C
V _{REF} (Common)	Output Current	ІОН	1, 3	_	5.0	_	_	mA
(Common)	Input Current	loL	1, 3	_	5.0	_	_	mA
	Permissive Input Current	IIM	1, 3	per each ch	30	_	_	μΑ
FI	Transfer Resistance	RT	1, 3	f = 100kHz	115	127	140	kΩ
FI ↓ RFO	Frequency Characteristic	f _C	2, 4	- 3dB point	3.0	_	_	MHz
(Common)	Output Signal Slew Rate	SR	2, 4	C _{RFO} = 20pF	10	20	_	V / μ s
	Total Harmonic Distortion	THD	1, 3	f = 100kHz V _{REO} = 1.27V _{p-p}	_	- 40	- 30	dB

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TECHNICAL DATA

СН	ARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
	Operation Reference VOPR 1, 3 VREF reference		- 1.13	- 0.88	- 0.72	٧		
FI ↓	Upper Limit Output Voltage	Vон	1, 3	V _{REF} reference	1.4		-	V
RFO (Common)	Lower Limit Output Voltage	V _{OL}	1, 3	V _{REF} reference			- 1.4	V
	Permissive Load Resistance	R _{LM}	_	_	10	_	_	kΩ
	Input Operating Voltage	VI	1, 3	_	0.8	_	1.6	V _{p-p}
	Voltage Gain	GV	1, 3	f = 1kHz	0.55	0.62	0.69	V/V
DEI	Peak Hold Frequency Characteristic	f _{CPD}	1, 3	_	60	120	240	kHz
RFI ↓ RFRP (Common)	Bottom Hold Frequency Characteristics	fCBD	1, 3	_	60	120	240	kHz
(Common)	Operation Reference Voltage 1	VOPR	1, 3	V _{REF} reference	- 0.61	- 0.55	- 0.49	٧
	Operation Reference Voltage 2	V _{OPR}	1, 3	V _{REF} reference 700kHz, 1V _{p-p} input	- 120	0	120	mV
	Permissive Load Resistance	R _{LM}	_	_	10	_	_	kΩ
	Transfer Resistance	R _T	1, 3	f = 1kHz	97	124	151	$\mathbf{k}\Omega$
	Gain Balance	GB	1, 3	f = 1kHz	- 1.5	_	1.5	dB
	Frequency Characteristic	f _c	1, 3	-3dB point	20	30	60	kHz
FI ↓ FEO (Common)	Total Harmonic Distortion	THD	1, 3	f = 1kHz $V_{FEO} = 1.7V_{p-p}$			- 40	dB
	Output Offset Voltage	Vos	1, 3	V _{REF} reference	- 100	_	100	mV
	Offset Voltage Drift	ΔV / ΔΤ	1, 3	_	- 400	_	400	μ V / ° C
	Upper Limit Output Voltage	Vон	1, 3	V _{REF} reference	1.5	_	_	V
	Lower Limit Output Voltage	V _{OL}	1, 3	V _{REF} reference	_	_	- 1.5	V

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TECHNICAL DATA

СН	ARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
	Permissive Input Current	IМ	1, 3	Per each ch	5.0		-	μΑ
	Transfer Resistance	R _T	1, 3	f = 1kHz	354	432	554	kΩ
	Gain Balance	GB	1, 3	f = 1kHz	- 2.0		2.0	dB
	Frequency Characteristic	f _C	1, 3		10	16	30	kHz
TI	Total Harmonic Distortion	THD	1, 3	$f = 1kHz$ $V_{TSO} = 0.8V_{p-p}$	_	_	- 40	dB
TSO (Common)	Output Offset Voltage	vos		V _{REF} reference	- 50	_	50	mV
	Offset Voltage Drift	ΔV/ΔΤ	1, 3	_	- 200		200	μ V / ° C
	Upper Limit Output Voltage	Voн	1, 3	V _{REF} reference	1.5	1	I	V
	Lower Limit Output Voltage	VOL	1, 3	V _{REF} reference	_	1	- 1.5	V
	Permissive Load Resistance	R _{LM}		_	10	_		kΩ
	Permissive Input Current	IMI	1, 3	Total in both ch	7.0	_		μΑ
	Transfer Resistance	R _T	1, 3	f = 1kHz	280	360	440	kΩ
	Frequency Characteristic	f _c	1, 3	- 3dB point	10	16	30	kHz
TI	Total Harmonic Distortion	THD	1, 3	f = 1kHz V _{SBAD} = 1.6V _{p-p}	_	_	- 40	dB
↓ SBAD (Common)	Operation Reference Voltage	V _{OPR}	1, 3	V _{REF} reference	- 0.88	-0.80	- 0.72	V
(6011111011)	Upper Limit Output Voltage	VOH	1, 3	V _{REF} reference	1.5	l		V
	Lower Limit Output Voltage	V _{OL}	1, 3	V _{REF} reference	_		- 1.5	٧
	Permissive Load Resistance	R _{LM}	_	_	10	_	_	kΩ
OSCI	Output Amplitude	٧o	_	f _{OSCI} = 0.5Hz (CMOS level)	610	700	780	mV _{p-p}
↓ FSO	Output Offset Voltage	Vos	_	OSCI : HiZ	- 35	_	35	mV
(Common)	Output Switch Isolation	V _{ISO}	_	f _{OSCI} = 0.5Hz SEL: "H" level	_	_	25	mV _{p-p}

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СН	IARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
	Voltage Gain 1	G _{V1}	_	f = 10kHz $V_{FSO} = 1V_{p-p}$	14.5	16.0	17.5	V/V
	Voltage Gain 2	G _{V2}		R_{NF} (FSO-FSN) : 12 $k\Omega$	1.79	2.11	2.43	V/V
FEO ↓	Upper Limit Output Voltage	VOH	_	GND reference	3.6		_	>
FSO (TA8190F)	Lower Limit Output Voltage	V _{OL}	_	GND reference	I	_	0.5	٧
(17.613017	Output Offset Voltage	Vos	_	_	- 32	_	32	mV
	Total Harmonic Distortion	THD	_	$f = 10kHz$ $V_{FSO} = 1V_{p-p}$		_	- 40	dB
	Voltage Gain 1	G _{V1}	_	$f = 10kHz$ $V_{FSO} = 1V_{p-p}$	14.5	16.0	17.5	V/V
	Voltage Gain 2	G _{V2}	_	R_{NF} (FSO-FSN) : $12k\Omega$	1.79	2.11	2.43	V/V
FEO	Upper Limit Output Voltage	Voн	_	GND reference	3.6	_	_	V
FSO (TA8191F)	Lower Limit Output Voltage	V _{OL}	_	GND reference	1	_	0.5	٧
(1761311)	Output Offset Voltage	vos	_	_	- 32	_	32	mV
	Total Harmonic Distortion	THD	_	f = 10kHz $V_{FSO} = 1V_{p-p}$	I		- 40	dB
	Voltage Gain	GV	_	f = 10kHz $V_{FAPO} = 1V_{p-p}$	80	96	114	V/V
FEO	Upper Limit Output Voltage	V _{OH}	_	GND reference	2.8	_	_	V
FEO ↓ FAPO	Lower Limit Output Voltage	V _{OL}	_	GND reference		_	- 2.8	٧
(TA8190F)	Output Offset Voltage	Vos	_	_	- 200		200	mV
	Total Harmonic Distortion	THD	_	$f = 10kHz$ $V_{FAPO} = 1V_{p-p}$ $R_L = 8\Omega$		_	- 40	dB

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TA8190F, TA8191F

TEST SYMBOL MIN. TYP. UNIT **TEST CONDITION** MAX. CHARACTERISTIC CIR-CUIT f = 10kHzVoltage Gain G_V 14.0 16.0 18.0 V/V $V_{FAPO} = 1V_{p-p}$ Upper Limit Output V **GND** reference 3.6 VOH FEO Voltage Lower Limit Output V V_{OL} **GND** reference 1.0 **FAPO** Voltage (TA8191F) Output Offset - 40 40 mV Vos Voltage Total Harmonic f = 10kHzTHD - 40 dB Distortion $V_{FAPO} = 1V_{p-p}$ f = 10kHz Voltage Gain G_V 0.95 1.00 1.05 V/V $V_{TS1O} = 1V_{p-p}$ Upper Limit Output V VOH GND reference 3.6 Voltage TS1P Lower Limit Output V VOL **GND** reference 1.0 Voltage TS10 Output Offset (Common) Vos - 5.0 5.0 mV Voltage Input Bias Current - 100 100 h nΑ Total Harmonic f = 10kHzTHD - 40 dB Distortion $V_{TS1O} = 1V_{p-p}$ f = 10kHzVoltage Gain 1.9 V/V G_V 2.0 2.1 $V_{TS2O} = 1V_{p-p}$ **Upper Limit Output GND** reference V 3.6 νон Voltage TS2P Lower Limit Output **GND** reference 0.5 V V_{OL} Voltage TS2O Output Offset (Common) Vos - 10 10 m۷ Voltage Input Bias Current - 100 100 П nΑ Total Harmonic f = 10kHzTHD - 40 dB Distortion $V_{TS2O} = 1V_{p-p}$

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Voltage

Voltage

Distortion

Output Offset

Total Harmonic

Vos

THD

DMPO

(TA8190F)

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- 100

TEST **SYMBOL** MIN. TYP. UNIT **TEST CONDITION** MAX. CHARACTERISTIC CIR-CUIT f = 10kHzVoltage Gain G_V 10.5 12.0 13.5 V/V $V_{TAPO} = 1V_{p-p}$ Upper Limit Output V **GND** reference 2.8 VOH Voltage TS2P Lower Limit Output V V_{OL} GND reference -2.8Ţ Voltage **TAPO** Output Offset (TA8190F) - 80 80 mV Vos Voltage f = 10kHzTotal Harmonic THD - 40 dΒ $V_{TAPO} = 1V_{p-p}$ Distortion $R_L = 8\Omega$ f = 10kHz Voltage Gain 5.7 6.7 7.7 V/VGγ $V_{DMEO} = 1V_{p-p}$ **Upper Limit Output** V ۷он **GND** reference 3.6 **DMEP** Voltage Lower Limit Output V_{OL} GND reference 0.5 ٧ DMEO Voltage (TA8191F) Output Offset - 15 15 m۷ Vos Voltage Total Harmonic f = 10kHz**THD** - 40 dB Distortion $V_{DMEO} = 1V_{p-p}$ f = 10kHz V/VVoltage Gain G_V 32 40 50 $V_{DMPO} = 1V_{p-p}$ **Upper Limit Output GND** reference 2.8 V VOH Voltage **DMEP** Lower Limit Output VOL٧ GND reference -2.8

f = 10kHz

 $R_L = 8\Omega$

 $V_{DMPO} = 1V_{p-p}$

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100

- 35

mV

dB

TA8190F, TA8191F

СН	IARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
	Voltage Gain	GV	_	f = 10kHz $V_{DMPO} = 1V_{p-p}$	5.4	6.7	8.0	V/V
DMEP	Upper Limit Output Voltage	VOH	_	GND reference	3.6	1		>
↓ DMPO	Lower Limit Output Voltage	VOL	_	GND reference			1.2	>
(TA8191F)	Output Offset Voltage	Vos	_	_	- 30	_	30	mV
	Total Harmonic Distortion	THD	_	f = 10kHz $V_{DMPO} = 1V_{p-p}$	_	_	- 40	dB
	Voltage Gain	GV	_	f = 10kHz VFMEO = 1V _{p-p} VFMEN = VREF	3.6	3.9	4.3	V/V
FMEP	Upper Limit Output Voltage	Voн	_	GND reference	3.6	_	_	V
↓ FMEO (TA8191F)	Lower Limit Output Voltage	V _{OL}	_	GND reference	_	_	0.5	٧
(1401311)	Output Offset Voltage	VOS	_	_	- 15	1	15	mV
	Total Harmonic Distortion	THD	_	f = 10kHz $V_{FMEO} = 1V_{p-p}$	_	-	- 40	dB
	Voltage Gain	GV	_	f = 10kHz $V_{FMPO} = 1V_{p-p}$	124	150	177	V/V
FMEP	Upper Limit Output Voltage	Vон	_	GND reference	2.8	_	_	>
FIVIEP ↓ FMPO	Lower Limit Output Voltage	V _{OL}	_	GND reference	_	_	- 2.8	٧
(TA8190F)	Output Offset Voltage	VOS	_	_	- 500	_	500	mV
	Total Harmonic Distortion	THD	_	$ f = 10kHz $ $V_{FMPO} = 1V_{p-p} $ $R_L = 8\Omega $	_	_	- 30	dB

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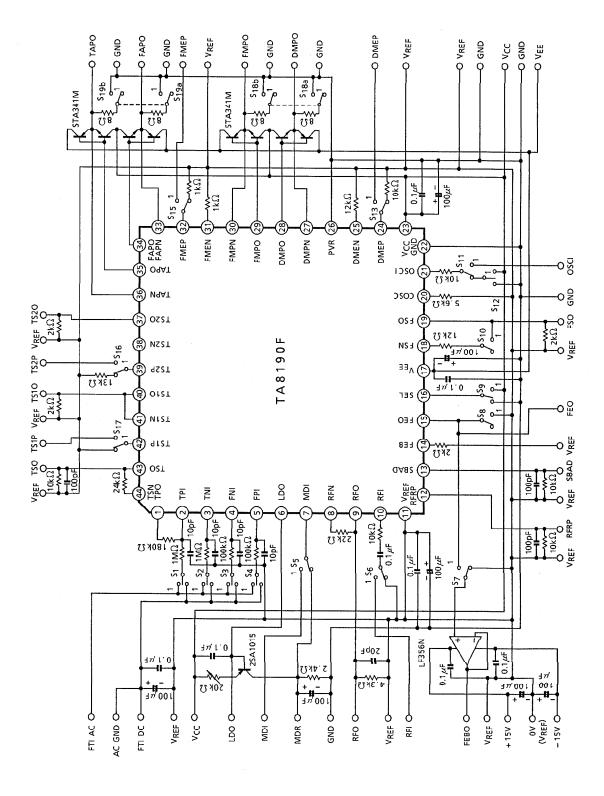
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СН	IARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
FMEP ↓ FMPO (TA8191F)	Voltage Gain	GV	_	f = 10kHz VFMPO = 1V _{p-p} VFMEN = VREF	3.4	3.9	4.6	V/V
	Upper Limit Output Voltage	VOH	_	GND reference	3.6	_	_	٧
	Lower Limit Output Voltage	VOL	_	GND reference	_	_	1.0	٧
	Output Offset Voltage	Vos	_	_	- 20	_	20	mV
	Total Harmonic Distortion	THD	_	f = 10kHz $V_{FMPO} = 1V_{p-p}$	_	_	- 40	dB
2VRN ↓ 2VR (TA8191F)	DC Voltage Gain	G _{VDC}		V _{2VR} = V _{REF}	1.90	2.00	2.10	V/V
MDI ↓ LDO (Common)	Reference Operating Voltage	VMDI	_	VMDI at which V _{LDO} becomes 3.5V.	170	178	192	mV
	Voltage Gain	GV	_	f = 10kHz $V_{LDO} = 0.5V_{p-p}$	170	200	230	mV
	Input Bias Current	l _l	_	_	- 200	_	200	nA
	Ripple Removing Ratio (With V _{CC})	RR	_	Input converted value			- 56	dB
	Frequency Characteristic	f _C	_	-3dB point	20			kHz
	LD Off Voltage (With V _{CC})	V _{LD} OFF	_	SEL = L	- 0.7	_	_	V

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TEST CIRCUIT 1

TECHNICAL DATA



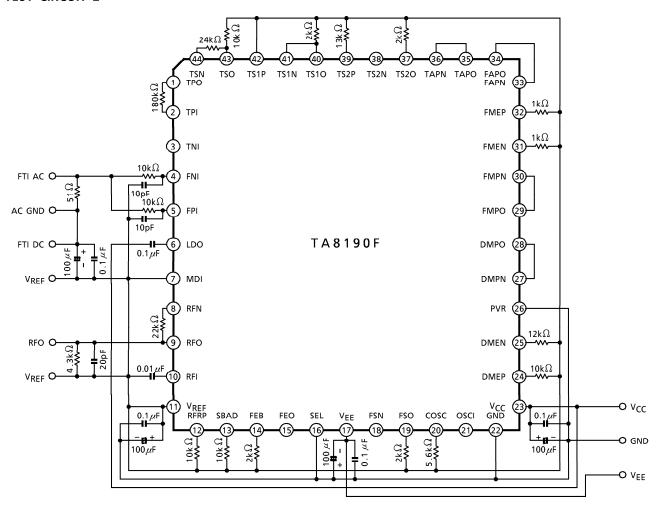
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1995 – 5 – 29	

TECHNICAL DATA

TA8190F, TA8191F

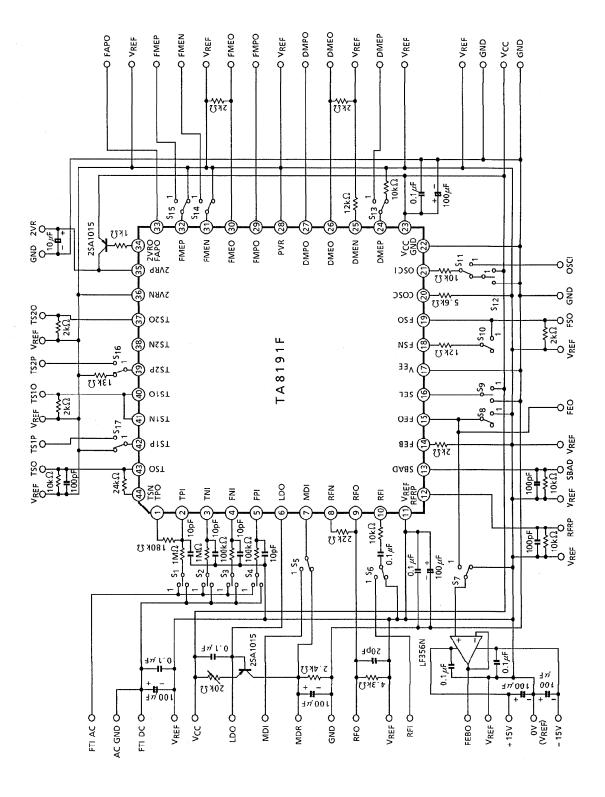
TEST CIRCUIT 2



TA8190F – 16	
1995 – 5 – 29	

TEST CIRCUIT 3

TECHNICAL DATA



TA8190F-17

TA8190F – 17	
1995 – 5 – 29	

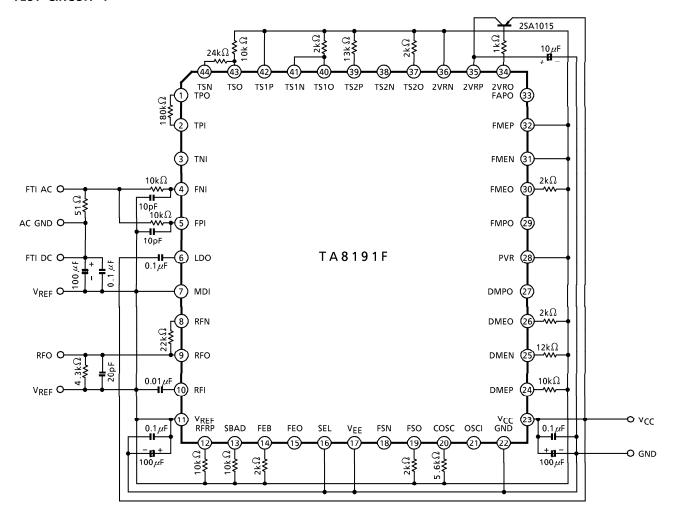
INTEGRATED CIRCUIT

TOSHIBA

TECHNICAL DATA

TA8190F, TA8191F

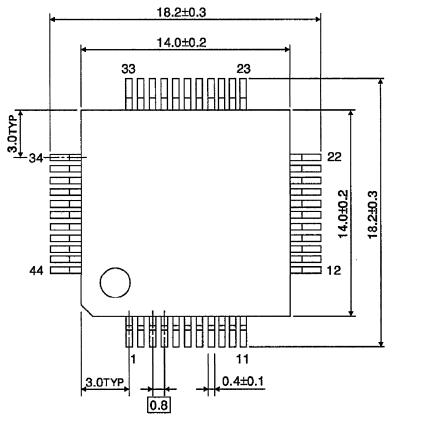
TEST CIRCUIT 4

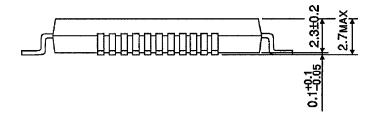


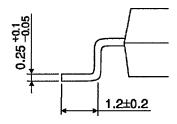
TA8190F – 18	
1995 – 5 – 29	



QFP44-P-1414B Unit: mm





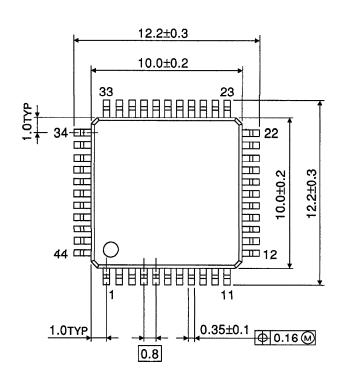


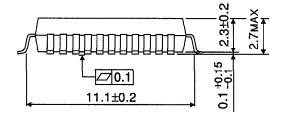
Weight: 1.15g (Typ.)

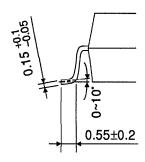
TA8190F – 19
1995 – 5 – 29
TOSHIBA CORPORATION

OUTLINE DRAWING QFP44-P-1010C

Unit: mm







Weight: 0.5g (Typ.)

TA8190F – 20*
1995 – 5 – 29
TOSHIBA CORROBATION